



## PHENIX MuId GAS OPS. IN THE PEH

procedure name

**PHENIX Procedure No. PP-2.5.2.13-10**

**Revision: D**

**Date: 1/20/2011**

### **Hand Processed Changes**

**HPC No.**

**Date**

**Page Nos.**

**Initials**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### **Approvals**

\_\_\_\_\_  
PHENIX S E & I    Date

\_\_\_\_\_  
Cognizant Scientist/Engineer    Date  
/Activity Manager

\_\_\_\_\_  
PHENIX Safety    Date

\_\_\_\_\_  
CA-D ES&H/ SAFETY    Date

## REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	AUTHOR	APPROVED BY	CURRENT OVERSIGHT
A	First Issue	n/a	n/a		n/a
B	No record of revision	18/05/01	n/a	M. Sivertz, A. Taketumi, Y. Makdisi, W. Lenz	n/a
B	No record of Revision. Note improper use of same revision letter.	12/4/2002	n/a	n/a	n/a
C	Attachment 2 Responsible People/Operators revised to replace Atushi Taketani with Rob Pisani	6/19/2007	R. Pisani	D. Lynch, R. Pisani, P. Giannotti, A. Etkin	R. Pisani
D	Reviewed for accuracy, no changes made except to update Rev letter and issue date	1/20/2011	R. Pisani	D. Lynch, R. Pisani, P. Giannotti, A. Etkin	R. Pisani

## **1. Purpose and Scope**

The scope of this procedure is those operations that are necessary for running the PHENIX Muon Identification Chambers (MuID) with mixture of CO<sub>2</sub> and i-C<sub>4</sub>H<sub>10</sub> as the chamber operation gas and N<sub>2</sub> for the secondary volume purge gas.

Operations in this procedure include the following:

1. Initiating the mixture of CO<sub>2</sub> and iso-C<sub>4</sub>H<sub>10</sub> flow into the MuID chamber
2. Stopping the mixture of CO<sub>2</sub> and iso-C<sub>4</sub>H<sub>10</sub> flow into the MuID chamber.
3. Initiating the N<sub>2</sub> flow.
4. Stopping the N<sub>2</sub> flow.

## **2. Responsibilities**

1. The operator is responsible for conducting these procedures, logging activities, and responding to values out of range.
2. Operators listed in Attachment 2 are known to be qualified to operate the MuID gas system.

## **3. Prerequisites**

1. The operator shall have completed BNL Compressed gas safety course (OSH026).
2. The operator shall have knowledge of the MuID gas system indicated by being listed as an operator in Attachment 2 of this procedure.

## **4. Precautions**

Over pressurization of the MUID (above 100 millibar) will result in severe structural damage. Primary care should be given to monitoring the internal pressure of the MUID throughout the duration of this procedure.

Before chamber outlet is pressurized well ( $>0.7''$ W.C.), compressor operation may damaged gas system by sucking unnecessary gas from low capacity vent line. Primary care should be given to monitoring the outlet pressure of the MUID when turning on compressors.

We are allowed to flow CO<sub>2</sub>/iC<sub>4</sub>H<sub>10</sub> mixture only under flammable limit, 9.3%. Primary care should be given to monitoring the gas mixture the duration of this procedure.

## **5. Procedure**

### **Remarks**

All Solenoid valves (SV) are controlled by the MuID gas system software or the supply valve control rack. All manual valves (MV) and flow indicators are on MuID gas rack or on gas room wall. MuID gas system software indicates the solenoid valve status within reasonably short time period, but other status may take more than 2 minutes to update.

**5.1 Initiating mixture of CO<sub>2</sub> and iso-C<sub>4</sub>H<sub>10</sub> flow into the MuID chamber.**

1. Go to the MuID chamber at the PHENIX IR.
2. Open fully all 30 needle valves which are located at west middle platform, east middle platform, and east side of the square hole.
3. Check that N<sub>2</sub> is flowing into the MuID secondary volume. If not, please follow the 5.3.
4. Go to the gas pad.
5. Verify that the CO<sub>2</sub> supply pressure is ~50 PSIG.
6. Verify that the i-C<sub>4</sub>H<sub>10</sub> supply pressure is ~25 PSIG.
7. Go to PC room of the gas-mixing house.
8. Turn on the MuID Gas PC.
9. Log on the PC with "gas" account and then start MuID gas system software.
10. Close all exiting SV on the gas rack except SV4 that control N<sub>2</sub> flow.
11. Open all SVs on south and north MuID part.
12. Go to the MuID gas rack.
13. Close MV4, MV1b, MV1c, MV3a, MV3, MV2, MV5, FI7, FI2, MV1, FI4, FI3 and FI1 by rotating clockwise, do not over tighten.
14. Remove a metal mesh on the right side of the MuID gas rack.
15. Close MV7.
16. Turn MV8 and MV9 to select to using SC1.
17. Reinstall a metal mesh on the right side of the MuID gas rack.
18. Go to CO<sub>2</sub> supply valve on north wall.
19. Open dedicated MuID CO<sub>2</sub> manual valve, MV/C18B by rotating slowly counter clockwise.
20. Check PI1 indicates > 20 PSI pressure.
21. Open dedicated MuID I-C<sub>4</sub>H<sub>10</sub> manual valves on the west wall, by rotating slowly counter clock wise.
22. Go to the valve control rack in the PC room.
23. Turn on the ISOBUTANE supply valve.
24. Go to the MuID gas rack.
25. Check PI2 indicating 15 PSIG pressure.
26. Go to the MuID PC rack.
27. Close CO<sub>2</sub> and I-C<sub>4</sub>H<sub>10</sub> toggling T1 and T2 to "close" position on the mass flow controller.
28. Set Knob-4 to "2".
29. Set Knob-3 to "set".
30. Turn Knob-2 to adjust CO<sub>2</sub> flow rate 29.7 lpm on the display.
31. Set Knob-4 to "1".
32. Turn Knob-1 to adjust I-C<sub>4</sub>H<sub>10</sub> flow rate 1.2 lpm on the display.
33. Set T1 and T2 to "auto" position. DO NOT set them "open" position.
34. Turn Knob-3 to "flow".
35. Open SV0, SV2 and SV3.
36. Go to the MuID gas rack.
37. Check PI5 indicating 50" W.C. pressure.
38. Adjust PI6 pressure 6" W.C. by using PCV0 and BPCV1.
39. Go to the MuID PC rack.
40. Open SV14.
41. Go to the MuID gas rack.
42. Open FI12, FI11, 6 turn counter clock wise from full closing position.
43. Check FI12, FI11 indicating 50 SCFH flow.
44. Check PI11 indicating < 6" W.C and not fracutuating.
45. Go to MuID PC rack.
46. Check CO<sub>2</sub> flow rate 29.7 lpm by setting Knob-4 to "2".
47. Check I-C<sub>4</sub>H<sub>10</sub> flow rate 1.2 lpm by setting Knob-4 to "1"
48. Open SV5.
49. Check SV6 is closed. If open, close SV6.
50. Go to the MuID gas rack.
51. Open FI3, FI5, and FI6 until indicating 1 lpm, 500 cc/min, and 500 cc/min respectively.
52. Check H<sub>2</sub>O and O<sub>2</sub> contamination is less than 100 ppm on the MuID PC rack.
53. Check PT6 on PC screen indicating more than 0.7" W.C. This may take more than a few hours. DO NOT proceed to next step until PT6 indicating > 0.7"W.C.

54. Go to the MuID gas rack.
55. Close FI10.
56. Open MV6 to vent.
57. Close MV5.
58. Go to the MuID PC rack.
59. Open SV12, SV14., SV11
60. Turn on SC1.
61. Go to the MuID gas rack.
62. Open FI10, FI9 slowly to adjust flow rate is 5 lpm. During this step, check PI9 indicating positive pressure. If it is zero or negative pressure, close FI10,FI9 immediately.
63. Close MV6.
64. Check PI9 indicate > 20" W.C. pressure.
65. Go to the MuID PC rack.
66. Close SV5 and open SV6.
67. Close MV6.
68. Check FI10,FI9 indicating 5lpm.
69. Adjust PCV2 to maintain FI5 and FI6 has 500-cc/min flows.
70. Go to the MuID PC rack.
71. Wait until H2O and O2 contamination level is less than 350ppm and 150ppm respectively. If H2O level is more than 1000 ppm, close SV6, open SV5 at MuID PC rack, and open MV6 at the MuID gas rack to vent. It may take more than few hours to reach these contamination levels as specified.
72. Close SV5.
73. Open SV6.
74. Go to the MuID gas rack.
75. Close MV6.
76. Remove a metal mesh on the right side of the MuID gas rack.
77. Open MV7.
78. Reinstall a metal mesh on the right side of the MuID gas rack.
79. Adjust flow rate on FI10 to 7 lpm by turning MV5 and FI10.
80. Check H2O and O2 contamination level less than 350 ppm and 150 ppm. It may take several minutes. If not close MV7 and repeat from step 68.

#### 5.2 Stopping mixture of CO2 and iso-C4H10 flow into the MuID chamber.

1. Go to MuID PC at the mixing house PC room
2. Check MuID gas system software is running. If not, start MuID gas system software.
3. Stop SC1 and SC2 when they run.
4. Close SV 12,SV11 when it opens.
5. Close SV6 and SV5.
6. Close SV3.
7. Confirm MV4 is closed.
8. Toggle T1 to "close".
9. Turn Knob-4 to "1" and turn Knob-3 to "flow".
10. Confirm zero flow on the mass flow controller display.
11. Toggle T2 to "close".
12. Turn Knob-4 to "2".
13. Confirm zero flow on the mass flow controller display.
14. Close SV2.
15. Close SV1, if it opens.
16. Go to the MuID gas rack.
17. Check PI5, PI6, and PI11 indicate zero pressure. It may take more than few minutes.
18. Go to the MuID PC rack.
19. Close SV14,SV13.
20. Go to the MuID gas rack.
21. Close FI12,FI11.
22. Close MV6 when it opens.
23. Close dedicated MuID CO2 manual valve, MV/C18B by rotating slowly clockwise.
24. Close dedicated MuID I-C4H10 manual valves on the west wall by rotating slowly clockwise.
25. Go to PHENIX gas control rack at the PC room.

26. Close I-C4H10 valve.

### **5.3 Initiating N2 flow.**

1. Go to the gas pad.
2. Verify that the N2 pressure supply is ~ 20 PSIG.
3. Go to the MuID gas rack.
4. Close valves on MuID gas rack, FI13, FI14.
5. Go to MuID PC rack.
6. Close SV4.
7. Minimize the output pressure at PCV1.
8. Check PI4 indicates near zero pressure.
9. Go to the north wall of gas mixing house.
10. Open dedicated MuID N2 manual valves.
11. Go to the MuID gas rack.
12. Check PI3 indicating more than 15 PSI.
13. Go to the MuID PC rack.
14. Open SV4.
15. Open PCV1 gradually, until PI4 indicating > 70" W.C.
16. Open FI14 until flow rate is 40 lpm.
17. Open FI13 until flow rate is 10 lpm.

### **5.4 Stopping N2 flow.**

1. Go to mixing house N2 inlet on north wall.
2. Close dedicated MuID N2 manual valve, by rotating slowly clockwise.
3. Go to MuID gas rack.
4. Close SV4 by MuID gas PC.
5. Close FI14 by rotating clockwise gently - DO NOT OVER-TIGHTEN.
6. Check FI14 indicates zero flow.
7. Close FI13 by rotating clockwise gently - DO NOT OVER-TIGHTEN.
8. Check FI13 indicates zero flow.

## **6 Documentation**

All notes and observations should be recorded in the MUID gas system logbook. A gas system log sheet (attachment 3) should be completed every 8 hours and placed in the log sheet binder while gas is flowing.

## **7 References**

1. MUID mixing room gas system schematic - PHENIX Drawing # 002-0213-701
2. MUID IR gas system schematic - PHENIX Drawing #002-0213-702

## **8 Attachments**

1. MUID Gas System Acronym Glossary
2. Responsible People/Operators
3. Gas system log sheet

## Attachment 1

## MUID GAS SYSTEM ACRONYM GLOSSARY

AB	Assembly building
BPCV	Back pressure control valve
CV	Check valve
F	Filter
FI	Flow indicator
FM	Mass flow controller
MV	Manual valve
PCV	Pressure control valve
PI	Pressure indicator
PS	Pressure switch
PSV	Pressure safety valve
PT	Pressure transmitter
SV	Solenoid valve
TT	Temperature transmitter
WAH	Wide angle hall

## Attachment 2: Responsible People/Operators

The following people have been trained to operate the PHENIX MUID gas system within the scope described in section 1.0 above. They have completed the prerequisite BNL training courses (see 3.1).

Leonid Kotchenda  
Rob Pisani  
Carter Biggs

Additional qualified users are to be listed below and posted in the MUID gas system mixing room:

[illegible]



## Attachment 3. PHENIX MUID GAS SYSTEM CHECK LIST

(To be filled out once per shift and placed in Gas System Binder)

Location	Sensor	Function	Value	Range	Comments
MuID gas rack	PI1	CO2 supply pressure		20-30 PSI	
MuID gas rack	PI2	I-C4H10 supply pressure		10-20 PSI	
MuID PC	FM1	CO2 flow rate		10-15 lpm	
MuID PC	FM2	I-C4H10 flow rate		1-1.5 lpm	
MuID gas rack	PI11	Supply pressure		4-6" W.C.	
MuID gas rack	FI12	Total flow		30-70 SCFH	
MuID PC	PT4	Chamber head pressure		1-2.5" W.C.	
MuID PC	PT6	Outlet pressure		0.5-1.0" W.C.	
MuID gas rack	FI10	Return flow		5-8 lpm	
MuID gas rack	PI9	Return compressed pressure		>40" W.C.	
MuID gas rack	FI6	H2O sensor flow		400-600 cc/min	
MuID gas rack	FI5	O2 sensor flow		400-600 cc/min	
MuID PC	H2O	H2O contamination		< 150 ppm	
MuID PC	O2	O2 contamination		< 400 ppm	

If any of the above are outside their normal range, immediately contact a MuID gas expert.

In addition, if PI6 or PI11 exceeds 7" W.C. then immediately shutdown the system by closing MV/C18B.

Operator \_\_\_\_\_

Date &amp; Time \_\_\_\_\_